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Evaluating the Performance of Cultural Strategies with Fuzzy Data Envelopment Analysis: A Case Study of Ecotourism Centers in Mazandaran Province

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Abstract

The increase in the number of tourists around the world has increased the necessity of planning for the promotion and development of tourism in order to minimize the environmental effects of tourism and maximize the social and economic benefits of tourism destinations. According to the current necessity, in this article, the identification and evaluation of the cultural performance of the ecotourism residences of Mazandaran province from the point of view of tourists has been discussed. The data of the present study is from the narratives related to the cultural strategies of the ecotourism centers of Mazandaran province in online social media. Narratives and data were obtained by searching tourism websites. In this article, the efficiency value of 39 ecotourism centers in Mazandaran province of Iran has been obtained with CCR input nature models and ranked with the Andersen-Petersen super-efficiency model. These ecotourism centers were evaluated with three entrances and three exits, and the inputs were the total land area of the ecotourist residence (square meters), the number of rooms in the ecotourism residence, and the maximum capacity of the ecotourism residence (persons). Also, the overall cleanliness of the ecotourism residence, the way of hosting the ecotourism residence personnel and staff, and the services of the ecotourism residence personnel and staff from the point of view of tourists were considered as the outputs of this study. The ranking of Decision-Making Units (DMUs) is also given. And finally, some solutions have been proposed to improve the situation of ineffective ecotourism resorts.

Keywords: Cultural performance evaluation, Ecotourism accommodations, Fuzzy data envelopment analysis, CCR input nature models, Andersen-Petersen hyper-efficiency.

1 | Introduction

The chance of sustainable development of the tourism industry increases by promoting special tourism, i.e., cultural ecotourism. In the era of globalization, authentic cultural heritage creates distinction and is an

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opportunity for the sustainable development of local communities. The harmonious integration of economic development, responsible governance, and the assurance of social cohesion and human nature forms the essence of sustainable development. The confirmed value of cultural ecotourism can be turned into a tourist product, an original and commercial product that can be expanded at the regional and national levels [1]. Organizations consider performance evaluation systems to evaluate and improve efficiency and strategic performance [2]. Performance evaluation refers to actions and information to increase the optimal use of facilities and resources. The performance in the "how to use resources" dimension is expressed as performance indicators. For a long time, performance evaluation has been one of the most important issues among scientists and business managers and one of the most important and extensive topics in organization management [3]. Without performance evaluation, it is impossible to act toward tourism growth and development, especially in ecotourism centers [4]. Ecotourism is an environmentally responsible travel and visit to pristine natural areas and understanding its benefits and cultural characteristics. Ecotourism is a sustainable strategy for earning money and preserving natural resources. Therefore, ecotourism should not be considered a program but a basic and macro strategy. Many countries that can develop ecotourism have implemented development and investment plans to create the necessary infrastructure to attract people interested in visiting ecotourism attractions [5].

Today, as a dynamic but nascent industry, ecotourism has gained increasing importance, and various developed and developing countries are working to protect the environment, reduce unemployment, improve income distribution, interact constructively and effectively with the world, and use its rich economic, social and political resources. They seek to expand nature tourism and facilitate it as a sustainable growth and development tool. However, proper and purposeful planning achieves success in tourism management and development. Mazandaran province, as the country's tourism hub with its unique natural capabilities that attract millions of domestic and foreign tourists every year, is apt for nature-based tourism to be considered the main development in this province. The province is the first step in setting the cycle of ecotourism in motion, introducing the existing potential capabilities, and identifying these areas due to their complexity, which requires consideration of criteria for evaluation [6].

The Data Envelopment Analysis (DEA) model first evaluates the organization's performance based on a logical model with a mathematical structure while simultaneously flexible. Second, it identifies inefficient units. Third, it determines the level of inefficiency of the units. Fourth, there is no standard level in advance, and the comparison criteria are other units operating under the same conditions. Fifth, it sets a model and reference for inefficient units among efficient units [7]. And external research by Nicula and Spânu [8] investigated the cultural promotion of ecotourism, Arsic et al. [1], Moradi et al. [5], Faraji Rad et al. [9], Hadizadeh Zargar [6], Shikhzahedi [10] have examined the concepts of strategy and performance evaluation separately. For more details [11–20]. None of them have evaluated the cultural performance of the ecotourism residences of Mazandaran province from the tourists' point of view, considering the importance of ecotourism in developing a sustainable economy and regional culture.

This article evaluates the cultural performance of the ecotourism residences in Mazandaran province from the tourists' point of view by using a search on ecotourism websites and online social networks. This article is organized as follows: in Section 2, the research method will be introduced. Section 3 presents the research background (improving cost efficiency by increasing outputs), Section 4 presents non-parametric methods, and Section 5 presents the identification and explanation of performance indicators. In Section 6, the paper ends with a discussion.

2 | Research Method

In terms of purpose, it is an applied research. Internet sites were also used to compile the theoretical foundations and background of the study using the library method, in addition to the books, publications, and documents available in the library. On the other hand, considering that this research is not based on statistical analysis, there is no need to determine the population and statistical sample in a special sense. This

research aims to identify and evaluate the cultural performance of the ecotourism residences of Mazandaran province from the tourists' point of view. The ecotourist resorts of Mazandaran province that have been studied and investigated in this research, in alphabetical order, these resorts are:

Bagh Amo Nasi Nashtarud Residence, Espi Ecotourist Residence in Kendlos, Pradrom Ecotourist Residence in Tonkabon, Perchin Abbas Abad Ecotourist Residence, Jana Ecotourist Residence in Tenkabon, Chubin Ecotourist Residence in Tenkabon, Surat Sari Ecotourist Residence, Shishaq Ecotourist Residence in Tenkabon, Koke Ramsar Ecotourist Residence, Kome Ecotourist Residence, Nane Kulthum Ramsar Ecotourist Residence, Yara Tenkaben Ecotourist Residence, Narenjestan Shaheswar Ecotourist Residence, Beyadmandani Ecotourist Residence in Ramsar, Tiamo Mah Asal Shirgah Ecotourist Residence, Tikish Ziba Ecotourist Residence, Haji Baba Swadkoh Ecotourist Residence, Khan Sere Shirgah Ecotourist Residence, Maderjun Tankabon House Ecotourist Residence, Madari Behshahr Ecotourist Residence, Kolbe Adel Babol Ecotourist Residence, Lia Ramser Ecotourist Residence, Maso Ecotourist Residence, Makhmel Bano Tenkaben Ecotourist Residence, Vanoshe Sahra Ecotourist Residence, Visheh Shirgah Ecotourist Residence, Yara Tenkaben Ecotourist Residence, Chubin traditional forest residence, Swadkoh Swiss Hut, Cham and Chasht Tankabon Ecotourist Residence, Arzoha House Ecotourist Residence in Ramsar, Kijasera Ramsar Ecotourist Residence, Main Sea Ecotourist Residence Papli Shirgah Unit, Plangkhel Ecotourist Residence, month and Fish Ecotourist Residence, Wheat Nest Hut, Forest Hut One-bedroom Bijan, two-bedroom Blue Ramsar cottage, Adel Shahr Babol cottage.

The data of the present study was collected from the narratives related to the cultural strategies of the ecotourism centers of Mazandaran province by searching the ecotourism websites and online social media. Analyzing the coverage of data is very important in evaluating efficiency among units. DEA has wide applications; it is a non-parametric mathematical optimization technique that evaluates the efficiency of DMUs with multiple inputs and outputs. Effective DMUs have more weight for each input and output than other units.

3|Research Background

3.1|A Review of the Literature on Ecotourism

The International Association of Ecotourism has described ecotourism as responsible travel to natural areas to protect the environment and maintain the well-being of local people [21]. It also contributes to the quality of life of local people by participating in economic-social activities [22]. Ecotourism, one of the components of alternative tourism development, emerged in response to the view that conventional mass tourism harms destination locations [23] and was originally developed based on sustainability. Because ecotourism activities are related to these areas' natural environment, historical heritage, and cultural patterns [24], this type of tourism is expected to increase tourism's positive environmental, economic, and socio-cultural results [25].

3.2| Ecotourist Residences

Ecotourism residences, as important service elements in ecotourism, include traditional huts or inns, inns, ecotourism camps, rural ecotourism, organic farms, ecotourism houses, and traditional hotels [26] meeting the following criteria [27].

I. Protection of the surrounding natural and cultural environment.

II. Using native architecture and materials.

III. Having a special cultural and physical texture according to the environment's form, landscape and color.

IV. Using sustainable water supply systems.

V. Reducing water consumption by using a working group from the local community.

Despite many differences with other tourist accommodation facilities, Ecotourism residences have left positive cultural effects on the host community and guests; adopting a cultural approach in targeting has limited and restrained the negative effects of ecotourism. The administration of this socio-economic institution requires a deep understanding of local culture and a coherent implementation plan [28]. Latifiyan et al. [29] investigated the service quality and willingness to reuse in local businesses, i.e., ecotourism accommodations in Golestan province, and their research results showed that all three components of service quality, context, and behavior in the willingness of tourists to return They have a direct and significant impact on Bo Megardi residences in Golestan province.

Qadiri Masoom et al. [19] investigated the role of ecotourism residences in developing rural tourism in the rural areas of Khor and Biobank. The results showed that the model of Bo Megradi residence in the rural area of Khor and Biyabank cities with local ownership and family management is more compatible with sustainable tourism development. Moradi et al. [5], in research titled "Designing an ecotourism development model for Tourism Target Villages in Kermanshah Province," showed that the economic factor is the priority, and the social and cultural factors, attractions, infrastructures, and facilities are organized, cooperative, managerial, and policy-making. They rank second to seventh in the development of ecotourism.

Rostam Pisheh et al. [30], in their research entitled "Evaluation and comparative analysis of the physical structure of eco-residences," studied talarkhane bardbar and Dilmai get eco-residences, Gilan Province " concluded that by knowing more about the attitudes of tourists and knowing the target market of tourism and their mentality, as well as discovering and knowing more about the native layers and old architecture of the province, it is possible to take steps towards improving the quality of services and physical expansion.

Rabani et al. [31] conducted their research investigating the attitude of eco-residence managers towards experience-oriented tourism in the case of research eco-residences in Isfahan province. They concluded that there is a comprehensive awareness of the concept of eco-residences among the managers of the residences. Therefore, it is necessary to provide information, create a suitable experience-based image and brand, and inform and train active human resources in this part of the industry. Anabastani et al. [31] conducted their research entitled "Investigation and Analysis of the Effects of creating ecotourism residences on the Development of Rural Settlements (example: Radkan village, Chenaran city), and the results showed that the factor of increasing production and income and strengthening local identity is the largest percentage And the physical-architectural and social-cultural factors have the lowest percentage of influence in the development of Radkan village.

Wardana et al. [32] conducted research entitled "Policy Models to Improve the Performance of Ecotourism to Create a Quality Tourism Experience and Sustainable Tourism," which concluded that ecotourism as a source of income, community participation, and conservation, and services as Successful factors in improving ecotourism performance are strategic management priorities to create quality tourism experiences and sustainable tourism. Ghaith et al. [33], in a study entitled Service Quality and Guest Satisfaction in Bou Megardi Resort, Egypt, concluded that service quality dimensions positively and significantly affect the perception of tourism guest service quality and satisfaction. Worku et al. [34], in research titled "Ecotourism Accommodations and Development of Tourism Infrastructure Around Yatashala Water Lakes National Park," from the perspective of sustainability assessment, determined that electricity is the main source of energy and the generator is used for support. All lodges have a septic tank for waste treatment. In a study, Larijani et al. [35] identified the cultural strategies of ecotourism centers in Mazandaran province of Iran with an approach based on thematic analysis. Proper use of resources by recycling is recommended Because the basic principle is sustainability.

Thuy et al. [35], in their study entitled "Eco-servant satisfaction and dissatisfaction: the asymmetric effects of service characteristics," presented a model called ECOSERV to measure the service quality of eco servants, which, in addition to the five dimensions of SERVQUAL, has one dimension. New and environmentally friendly has been added to it.

In a research [36] titled "Evaluation of the quality of hospitality services in ecotourism resorts," it was found that changes should be made so that the customer visits the destination again and the components fully satisfy the customer's perception. In domestic published articles, the authors have presented the results of their reviews of the quality of ecotourism accommodation services concerning job creation, returning tourists, and raising the quality level of services, and in foreign research, researchers have analyzed and investigated the relationships and the use of models were after the influential factors in the satisfaction and dissatisfaction of tourists. In an article, Mohammad Shafiei [37] discussed ranking marketing communication channels using the fuzzy hierarchical analysis method to select the most suitable channel. Vazin Karimian et al. [38] investigated organization performance measurement based on human resource management indicators using fuzzy multi-criteria decision-making techniques (case study: organizations affiliated with Isfahan Municipality). Sun [39] evaluated different computer companies using a fuzzy hierarchical analysis process and fuzzy TOPSIS. Passengers suggested. A hybrid method of Analytical Hierarchy and TOPSIS process with generalized second-type fuzzy sets to select the appropriate carrier type in sea transportation was proposed by Celik et al. [40].

4 | Non-Parametric Methods

Non-parametric methods generally compare the performance of a firm or DMU with the actual best performance of firms within that industry. Non-parametric methods can be considered the simplest methods of observing and estimating efficiency. There should be a standard limit to determine the effectiveness of each specific observation, which requires considering observations with similar characteristics. At the level of non-parametric models, there are various methods to observe inefficiency, which include [41].

4.1 | Views of the Nature of the Input and the View of the Nature of the Output

Before examining the estimation methods, referring to the input and output nature estimation criteria is necessary. These two criteria lead to similar results but different methods of analysis, and they are chosen according to the needs of the researcher and the organization regarding how to move and change the amount of data and output in terms of flexibility in how these changes are made.

I. Criterion of nature of input: we are looking for an answer to the question of how much we can reduce the amount of inputs without affecting the amount of the product.

II. Criterion of the nature of the output: we are looking for an answer to how much output can be increased with the same amount of data [40].

4.2 | DEA

In the past few decades, DEA has been proposed as an important method for performance measurement. Using this method for evaluation is a suitable method that helps the decision maker by measuring the performance of DMU and ranking [41].

The data coverage analysis method considers the efficiency of each company into a fraction that includes the weighted sum of outputs and inputs. Farrell [42] was the first person to propose a non-parametric method using linear programming. DEA measures the efficiency of several similar operating units called DMUs.

4.3 | Determining the Appropriate Model

The main models of data coverage analysis can be checked in two ways. These two procedures are the procedures of input nature and output nature. This is because, in ecotourism residences, the inputs are more under the control of management than the outputs. Therefore, in evaluating the performance of ecotourism accommodations, the input nature model is superior to the output nature model. Finally, the proposed model for the current research is the CCR model of input nature with fuzzy data.

4.4 | Basic Models of DEA

DEA is a non-parametric method used to evaluate the performance of a set of homogeneous DMUs. One of the major strengths of DEA is that it does not require information about complex relationships between inputs and outputs. Therefore, it can be used without prior knowledge of the relative importance of inputs and outputs. For this reason, DEA has become an attractive and practical method for performance analysis and evaluation. Charles and his colleagues in 1978 presented the following models to evaluate the efficiency of the DMU.

4.4.1 | CCR Model

By using a linear programming model, Charnes, Cooper, and Rhodes turned multiple inputs and outputs into one input and one output by assigning the weights obtained from solving the model and evaluating the efficiency. They did. The model they presented became known as the CCR model [43]. *Model (1)*, which is known as the CCR model of the envelope form with input nature, is always feasible and has a finite optimality, and the optimal solution applies to the condition $0 < \theta^* \leq 1$.

$$\min \theta$$

$$\text{s.t.}$$

$$\sum_{j=1}^{n} \lambda_j x_{ij} \leq \theta x_{io}, \qquad i = 1, 2, \dots, m,$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{ro}, \qquad r = 1, 2, \dots, s,$$

$$\lambda_j \geq 0, \qquad j = 1, 2, \dots, n, \quad \theta \text{ is free.}$$

In *Model (1)*, n is the number of DMUs of DMU_j and $j = 1,2,\dots,n$ each of the DMUs m to different inputs $x_{ij}, i = 1,\dots,m$ to produce s to output $y_{rj}, r = 1,\dots,s$ consume. The necessary condition for efficiency under the above model is $\theta^* = 1$, otherwise it is inefficient. If $\theta^* < 1$, then DMU_p is inefficient in the nature of the input and $(1 - \theta^*)$ is the value of its technical inefficiency in the nature of the input.

4.4.2 | Anderson and Peterson super efficiency ranking model

In 1993, Anderson and Peterson [44] introduced the Super Efficiency model, which is known as the AP model. In this method, to rank DMUo, it is removed from the related production possibility set, and the DEA model is implemented for the rest of the DMUs. Their proposed model for ranking DMUo is as follows:

$$\min \theta$$

$$\text{s.t.}$$

$$\sum_{\substack{j=1 \\ j \neq o}}^{n} \lambda_j x_{ij} \leq \theta x_{io}, \qquad i = 1, 2, \dots, m,$$

$$\sum_{\substack{j=1 \\ j \neq o}}^{n} \lambda_j y_{rj} \geq y_{ro} \quad r = 1, 2, \dots, s,$$

$$\lambda_j \geq 0, \quad j = 1, 2, \dots, n, \quad \theta \text{ is free.}$$

Definition 1. The fuzzy number A defined on the set of real numbers is called a triangular fuzzy number. If its membership function $\mu_{\tilde{A}}(x): R \to [0,1]$ is as follows:

$$\mu_{\tilde{A}}(x) = \begin{cases} \dfrac{x - l}{m - l}, & l \le x \le m, \\ \dfrac{u - x}{u - m}, & m \le x \le u, \end{cases}$$

where l and u are the lower bound and upper bound, respectively, of the triangular fuzzy number A and m is its kernel (*Fig. 1*). Fuzzy number A is represented by the symbol $A = (l, m, u)$.

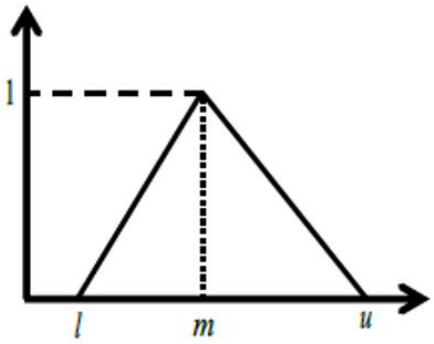

Fig. 1. Triangular fuzzy number membership function.

Definition 2. A triangular fuzzy number $A = (l, m, n)$ is called positive when $l > 0$.

In this article, the outputs of the DMUs are determined based on the opinions of tourists and ecotourists on ecotourism accommodations using linguistic expressions. Tourists of eco-residences use language expressions to record their level of satisfaction with the general cleanliness of the eco-residence, the way of hosting the personnel and staff of the eco-residence, and the services of the personnel. In this case, using numerical values to express linguistic expressions is not logical.

Therefore, by generalizing the above method, the researchers used fuzzy numbers to express the degree of preference. This research uses 9 triangular fuzzy numbers to transform the concept of a linguistic expression into a fuzzy number that tourists and ecotourists express. The calculation technique used in this research is based on the triangular fuzzy numbers suggested by Gumus [45], shown in *Table 1*.

Table 1. Membership function of linguistic expressions.

Fuzzy Number	Linguistic Expression	Triangular Membership Function
9	(Prefect)	(8,9,10)
8	(Absolute)	(7,8,9)
7	(Very Good)	(6,7,8)
6	(Fairly Good)	(5,6,7)
5	(Good)	(4,5,6)
4	(Preferable)	(3,4,5)
3	(Not Bad)	(2,3,4)
2	(Weak Advantage)	(1,2,3)
1	(Equal)	(1,1,1)

4.4.3 | Ranking of fuzzy numbers

In this research, the method proposed by Yu and Dat [46] is used to compare fuzzy numbers based on left and right integral values. Suppose that $A_i = (l_i, m_i, u_i)$, n are triangular fuzzy numbers and $x_{min} = \min\{l_i, i = 1,2,\ldots,n\}$. The left integral ($S_L(A_i)$) and the right integral ($S_R(A_i)$) of the fuzzy number A_i are defined as follows:

$$S_L(A_i) = (m_i - x_{min}) - \int_{l_i}^{m_i} \frac{x - l_i}{m_i - l_i} dx = \frac{1}{2}(l_i + m_i - 2x_{min}).$$

$$S_R(A_i) = (m_i - x_{min}) + \int_{m_i}^{u_i} \frac{u_i - x}{u_i - m_i} dx = \frac{1}{2}(m_i + u_i - 2x_{min}).$$

Now, the total integral value of the fuzzy number A_i is obtained based on the average of the left and right integral values as follows:

$$S_T(A_i) = \frac{1}{4}(l_i + m_i + u_i - 2x_{min}).$$

The approach proposed by Yu and Dat [39] uses the total integral value of $S_T(A_i)$ to compare triangular fuzzy numbers. The larger the integral value is, the larger the fuzzy number is, so the following properties hold for both fuzzy numbers A_i and A_j :

I. If $S_T(A_i) > S_T(A_j)$ then $A_i \succ A_j$.
II. If $S_T(A_i) < S_T(A_j)$ then $A_i \prec A_j$.
III. If $S_T(A_i) = S_T(A_j)$ then $A_i \approx A_j$.

5 | Identification and Explanation of Performance Indicators

In this section, we will evaluate the cultural performance of 39 ecotourism resorts in Mazandaran province, Iran, from the point of view and opinions of ecotourism centers' tourists on ecotourism websites and online social media. For this purpose, the present study's data has been collected from the related narratives on the virtual pages of ecotourism and online social media that provide ecotourism services.

Inputs (X)

x_1: the total land area of the ecotourist residence is square meters.

x_2: number of rooms in Bom-Gordi residence.

x_3: maximum capacity per person of tourism accommodation.

Outputs (Y) (according to the proposed triangular fuzzy numbers, the score is 9).

y_1: The overall cleanliness of the ecotourism accommodation is, according to tourists.

y_2: how to host the personnel and staff of the ecotourism accommodation from the point of view of tourists.

y_3: services and services of the personnel and staff of the tourist accommodation in terms of tourists. The obtained information is shown in *Table 2*.

Table 2. Data to DMUs including 3 inputs and 3 triangular fuzzy outputs.

	Inputs			Outputs: Triangular Fuzzy Numbers								
				$\widetilde{y_1} = (y_{1l}, y_{1m}, y_{1u})$			$\widetilde{y_2} = (y_{2l}, y_{2m}, y_{2u})$			$\widetilde{y_3} = (y_{3l}, y_{3m}, y_{3u})$		
	X1	X_2	X_3	y_{1l}	y_{1m}	y_{1u}	y_{2l}	y_{2m}	y_{2u}	y_{3l}	y_{3m}	y_{3u}
DMU1	800	2	25	4	5	6	4	5	6	4	5	6
DMU2	1200	5	14	6	7	8	6	7	8	6	7	8
DMU3	2000	6	18	6	7	8	6	7	8	6	7	8
DMU4	6000	1	6	6	7	8	6	7	8	6	7	8
DMU5	2500	2	18	6	7	8	6	7	8	8	9	10
DMU6	800	2	6	8	9	10	6	7	8	8	9	10
DMU7	500	3	8	6	7	8	6	7	8	6	7	8
DMU8	200	2	8	6	7	8	6	7	8	6	7	8
DMU9	1000	1	2	6	7	8	6	7	8	4	5	6
DMU10	7000	1	25	6	7	8	6	7	8	6	7	8

Table 2. Continued.

	Inputs			Outputs: Triangular Fuzzy Numbers								
				$\widetilde{y_1} = (y_{1l}, y_{1m}, y_{1u})$			$\widetilde{y_2} = (y_{2l}, y_{2m}, y_{2u})$			$\widetilde{y_3} = (y_{3l}, y_{3m}, y_{3u})$		
	X1	X_2	X_3	y_{1l}	y_{1m}	y_{1u}	y_{2l}	y_{2m}	y_{2u}	y_{3l}	y_{3m}	y_{3u}
DMU11	650	3	12	6	7	8	6	7	8	6	7	8
DMU12	500	2	8	6	7	8	6	7	8	6	7	8
DMU13	400	1	6	8	9	10	8	9	10	4	5	6
DMU14	30000	1	6	8	9	10	8	9	10	8	9	10
DMU15	700	1	5	6	7	8	6	7	8	6	7	8
DMU16	3000	3	20	6	7	8	6	7	8	6	7	8
DMU17	500	2	6	6	7	8	6	7	8	6	7	8
DMU18	3000	3	12	6	7	8	6	7	8	6	7	8
DMU19	2000	3	25	6	7	8	6	7	8	6	7	8
DMU20	1500	1	3	6	7	8	6	7	8	8	9	10
DMU21	1000	2	12	8	9	10	8	9	10	8	9	10
DMU22	2000	8	50	6	7	8	6	7	8	6	7	8
DMU23	1000	2	15	6	7	8	6	7	8	6	7	8
DMU24	3000	10	40	6	7	8	6	7	8	6	7	8
DMU25	3000	4	8	8	9	10	6	7	8	6	7	8
DMU26	2000	2	20	6	7	8	6	7	8	6	7	8
DMU27	1500	1	5	8	9	10	6	7	8	8	9	10
DMU28	1200	2	10	6	7	8	6	7	8	6	7	8
DMU29	2000	5	20	8	9	10	6	7	8	6	7	8
DMU30	650	2	25	6	7	8	6	7	8	6	7	8
DMU31	1000	4	24	6	7	8	6	7	8	6	7	8
DMU32	1500	1	7	6	7	8	6	7	8	6	7	8
DMU33	20000	1	5	6	7	8	6	7	8	6	7	8
DMU34	8000	5	40	4	5	6	4	5	6	4	5	6
DMU35	1000	1	5	4	5	6	6	7	8	8	9	10
DMU36	2000	1	4	6	7	8	6	7	8	8	9	10
DMU37	300	2	12	4	5	6	6	7	8	8	9	10
DMU38	500	1	4	6	7	8	6	7	8	6	7	8
DMU39	8000	2	4	6	7	8	8	9	10	6	7	8

Table 3. Non-fuzzy values of output data and results of CCR model and AP super-efficiency model and ranking of DMUs.

	Non-Fuzzy Values of Outputs			Efficiency and Super-Efficiency and Ranking		
	y_1	y_2	y_3	θ_{CCR}	θ_{AP}	Rank
DMU1	3	3	3	0.3429	0.3429	31
DMU2	5	5	5	0.3556	0.3556	30
DMU3	5	5	5	0.2388	0.2388	36
DMU4	5	5	5	0.8478	0.8478	14
DMU5	5	5	7	0.5000	0.5000	24
DMU6	7	5	7	0.9211	0.9211	12
DMU7	5	5	5	0.7273	0.7273	19
DMU8	5	5	5	1.0000	1.7500	1
DMU9	5	5	3	1.0000	1.5000	3
DMU10	5	5	5	0.8412	0.8412	16
DMU11	5	5	5	0.5161	0.5161	23
DMU12	5	5	5	0.7273	0.7273	20
DMU13	7	7	3	1.0000	1.6000	2
DMU14	7	7	7	1.0000	1.2353	7
DMU15	5	5	5	0.9459	0.9459	11
DMU16	5	5	5	0.2940	0.2940	34
DMU17	5	5	5	0.8421	0.8421	15
DMU18	5	5	5	0.3016	0.3016	33
DMU19	5	5	5	0.3182	0.3182	32
DMU20	5	5	7	1.0000	1.3333	4
DMU21	7	7	7	0.7000	0.7000	21

Table 3. Continued.

	Non-Fuzzy Values of Outputs		Efficiency and Super-Efficiency and Ranking			
	y_1	y_2	y_1	y_2	y_1	y_2
DMU22	5	5	5	0.1818	0.1818	37
DMU23	5	5	5	0.5000	0.5000	25
DMU24	5	5	5	0.1333	0.1333	38
DMU25	7	5	5	0.4286	0.4286	28
DMU26	5	5	5	0.4411	0.4411	27
DMU27	7	5	7	1.0000	1.2316	8
DMU28	5	5	5	0.4861	0.4861	26
DMU29	7	5	5	0.2862	0.2862	35
DMU30	5	5	5	0.6400	0.6400	22
DMU31	5	5	5	0.3636	0.3636	29
DMU32	5	5	5	0.8786	0.8786	13
DMU33	5	5	5	0.7811	0.7811	17
DMU34	3	3	3	0.1053	0.1053	39
DMU35	3	5	7	1.0000	1.1667	9
DMU36	5	5	7	1.0000	1.0000	10
DMU37	3	5	7	1.0000	1.2444	6
DMU38	5	5	5	1.0000	1.2670	5
DMU39	5	7	5	0.7500	0.7500	18

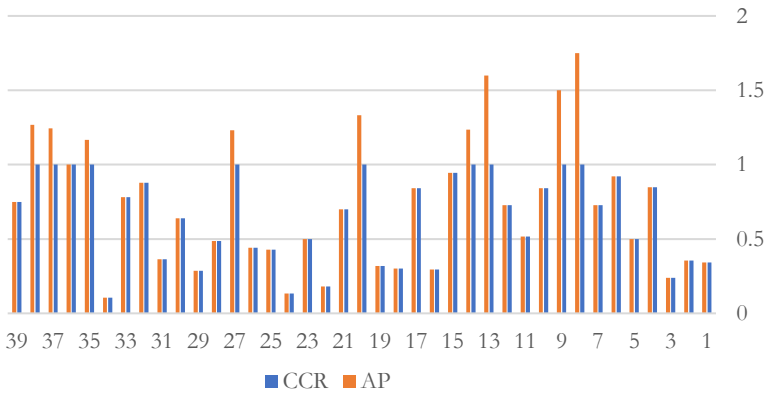

Fig. 2. Comparison of CCR efficiency and AP super-efficiency.

Table 2 shows the data of $n = 39$ DMUs with $m = 3$ inputs and $s = 3$ triangular fuzzy outputs, and in *Table 3*, the non-fuzzy values of the output data of the DMUs obtained from the method proposed by Yu and Dat along with the results CCR input nature models and AP super performance ranking model are presented. The ranking of DMUs is also given. As can be seen, 11 tourist accommodations, equal to 28% of ecotourism accommodations compared to other ecotourism accommodations with the CCR model, were efficient, and the rest were ineffective. That is, the value of $\theta^*_{CCR} = 1$ has been obtained for them, and the rest of the tourist accommodations have $\theta^*_{CCR} < 1$.

which have been ranked for the ranking of 11 efficient DMUs from the CCR model with the help of the AP super-efficiency ranking model, which DMUs DMU_8, DMU_{13} and $DMU_{\text{؟}}$ with a super-efficiency score of $\theta^*_{AP} = 1.75$, $\theta^*_{AP} = 1.6$ and $\theta^*_{AP} = 1.5$, respectively, the most efficient DMU_{34}, DMU_{24}t, and DMU_{22} with the efficiency scores of $\theta^*_{CCR} = 0.1053$, $\theta^*_{CCR} = 0.1333$, and $\theta^*_{CCR} = 0.1818$ are the most inefficient DMUs, respectively. For these inefficient units to improve their efficiency, they can use DMU_8, DMU_{20} and DMU_{27} as a benchmark and become a better DMU.

6 | Discussion

According to the culture and geography of the region, ecotourism residences have been established in a way compatible with the region's historical context and natural landscape. With maximum interaction with the local community and attention to climatic diversity, they provide the presence of tourists with an acceptable and defined quality. The main purpose of the research was to evaluate the cultural performance of the ecotourism residences in Mazandaran province from the point of view of tourists; for this purpose, this article, by using the search in ecotourism websites and online social media to evaluate the cultural performance of the ecotourism residences in Mazandaran province from the point of view of tourists was discussed. The analysis of the results shows that the efficiency of ecotourism residences depends on the performance of the staff and the accommodation complex. The empathy and confidence that the staff instills in the resident ecologist should be such that it gains the ecologist's trust and credibility in providing quality services. The existence of suitable amenities, internet, road signs, food safety, etc., are important. For example, if the founders of the residence complex have not built it away from a lot of noise and have not installed proper road signs to reach the residence, the ecologist will take care of these things. They consider their presence as indifference. Handicraft art training, controlling the positive image of the destination, and the emotional value of attractions are the components that have been considered in studies to attract more tourists and influence their experiences. Providing better services, measures such as providing tools and facilities for the joy and happiness of ecotourists by holding various festivals and rituals, paying attention to creating lasting memories, as well as educating and learning ecotourists are among the important things and are also considered as programs of the tourism organization.

Conflict of Interest

The authors declare no conflict of interest.

Data Availability

All data are included in the text.

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